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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,646	10/24/2003	John Kevin McCoy	12093/930	8631

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EXAMINER	
LIGHTFOOT, ELENA TSOY	
ART UNIT	PAPER NUMBER
1792	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/692,646	MCCOY, JOHN KEVIN	
	Examiner	Art Unit	
	Elena Tsoy Lightfoot	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 March 2008*.

2a)☒ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4,6-10 and 12-16* is/are pending in the application.

4a) Of the above claim(s) *13-16* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4,6-10 and 12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 12, 2008 has been entered.

Response to Amendment

Amendment filed on August 12, 2008 has been entered. Claim 11 has been cancelled. Claims 1, 2, 4, 6-10 and 12-16 are pending in the application. Claims 13-16 are withdrawn from consideration as directed to a non-elected invention.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Rejection of claim 11 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement has been withdrawn due to cancellation of the claim.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Rejection of claims 1, 4, 6-9, and 11-12 under 35 U.S.C. 103(a) as being unpatentable over Carley-Macauly et al (US 3164487) in view of Nicholson et al (US 3, 035,325) and Mysels (US 4,073,834) has been withdrawn due to amendment.

5. Rejection of claim 11 under 35 U.S.C. 103(a) as being unpatentable over Carley-Macauly et al in view of Nicholson et al and Mysels, and further in view of GB '789 has been withdrawn due to cancellation of the claim.

6. Claims 1, 2, 4, 6-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carley-Macauly et al in view of Nicholson et al and Mysels, and further in view of Burnham et al (US 3,129,141) and Smith et al (US 6190162).

Carley-Macauly et al discloses a method of producing carbon-impregnated nuclear fuel element with very low permeability to gases (See column 1, lines 11-16) comprising impregnating a porous artifact having high open porosity and low thermal conductivity (See column 1, lines 20-21) such as nuclear fuel material (See column 3, lines 5-10), e.g. uranium dioxide (claimed porous uranium dioxide arrangement) (See column 1, lines 62, 66-67) or a porous silicon carbide (See column 3, lines 33-34) or porous silica or alumina (See column 2, lines 33-34) by pyrolysis of methane and other hydrocarbons (See column 4, lines 21-45).

Carley-Macauly et al fails to teach that carbon is impregnated by infiltrating a liquid carbon precursor.

Nicholson et al teaches that carbon can be deposited in the pores of substantially *any* refractory body having intercommunicating network by any available technique (See column 6,

lines 10-16) such as pyrolysis of methane and other hydrocarbons (See column 6, lines 20-21) and impregnation of the porous body with phenol-formaldehyde based resinous solution (See column 5, lines 63-70) or furfural or -the like, followed by carbonization by acidification (See column 6, lines 21-22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have deposited carbon in the cited prior art using impregnation technique with a liquid precursor instead of pyrolysis of methane and other hydrocarbons since Nicholson et al teach that these techniques are functionally equivalent to each other for depositing carbon in the pores of substantially *any* refractory body having intercommunicating network.

Carley-Macauly et al in view of Nicholson et al fails to teach that the impregnated liquid carbon precursor is converted to carbon by curing and firing the arrangement (Claim 2); curing at temperature of 180-400^{0}C (Claim 6) and firing at temperature of 850-1700^{0}C (Claim 7) or 1500-1700^{0}C (Claim 8).

Mysels teaches that carbon can be deposited in the pores in a fuel arrangement (See column 3, lines 50-65) from impregnant such as phenol-formaldehyde prepolymer (See column 4, 112-13) or furfuryl alcohol monomer/prepolymer (See column 4, lines 5-8) by **curing** first the prepolymer (See column 4, lines 10-12) and decomposing the cured polymer at temperature of 200-800^{0}C (See column 4, lines 35-37) and carbonizing at 1200^{0}C or **higher** (claimed firing) (See column 4, lines 33-34).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated a porous body of Carley-Macauly et al in view of Nicholson et al with phenol-formaldehyde prepolymer or furfuryl alcohol monomer/prepolymer precursor

followed by curing/decomposing at 200-800^{0}C and carbonizing at 1200^{0}C or **higher** with the expectation of providing the desired deposited carbon in the pores of a body, as taught by Mysels.

Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant temperature parameters (including those of claimed invention) in the cited prior art through routine experimentation in the absence of showing criticality.

The cited prior art fails to teach that silicon carbide is used instead of carbon (Claim 10); the fired arrangement has a higher thermal conductivity than the arrangement without infiltration of the uranium dioxide with the precursor liquid (claim 1).

Burnham et al teaches that some of the ideal characteristics sought in a nuclear reactor fuel element are: good thermal conductivity, high heat resistance and heat shock resistance, corrosion resistance, high mechanical strength even at elevated temperatures (See column 1, lines 14-18), and comprises a dense body comprising uraniuin carbide, graphite, silicon carbide (See column 1, lines 33-36). In other words, Burnham et al teaches that silicon carbide is suitable for making a dense body of a nuclear reactor fuel element. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated a porous nuclear reactor fuel body in the cited prior art with silicon carbide with the expectation of providing the desired dense body because Burnham et al teaches that silicon carbide is suitable for making a dense body of a nuclear reactor fuel element. It is held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness

determination in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945). See MPEP 2144.07.

The cited prior art fails to teach that silicon carbide is deposited by infiltrating a porous nuclear reactor fuel body with a liquid *allylhydridopolycarbosilane* followed by curing and firing (Claim 2).

Smith et al teaches that SiC may be deposited on a substrate by applying to the substrate a liquid pre-ceramic polymer AHPCS, *curing* the polymer at temperature **250^{0}C - 400^{0}C** to a silicon carbide pre-ceramic polymer mixture preferably containing about 96% SiC, about 2% oxygen, and about 2% carbon (See column 3, lines 25-44), then pyrolyzing the silicon carbide pre-ceramic polymer mixture at temperatures up to about 1,000^{0}C preferably in the range of **800^{0}C - 1,000^{0}C** in an inert gas atmosphere such as nitrogen or argon (See column 3, lines 45-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have deposited SiC in the cited prior art by infiltrating a porous nuclear reactor fuel body with a liquid *allylhydridopolycarbosilane* followed by curing and firing, as taught by Smith et al.

As to claims 7-8, note that the firing range of **800^{0}C - 1,000^{0}C** in Smith et al overlaps claimed range of 850^{0}C - 1700^{0}C. Overlapping ranges are *prima facie* evidence of obviousness. Therefore, it would have been obvious to one having ordinary skill in the art to have selected the portion of Smith et al's range that corresponds to the claimed range. *In re Malagari*, 184 USPQ 549 (CCPA 1974).

As to claim 9, obviously the shape of body could be of any form known in the art including pellets.

Response to Arguments

7. Applicants' arguments filed March 5, 2008 have been fully considered but they are not persuasive.

Rejection of Claims 1, 2, 4, 6-9, 11-12 under 35 U.S.C. §103(a).

Rejection over Carley-Macauley et al in combination with Nicholson et al and Mysels

(A) Applicants submit that in contrast to the presently claimed invention, Carley-Macauly discloses methods of producing carbon-impregnated artifacts. The carbon-impregnated artifacts are produced by placing an artifact, having high open porosity and low thermal conductivity, in an atmosphere of hydrocarbon gas. While the artifact is in the atmosphere of hydrocarbon gas, an initial zone of the artifact is heated to a temperature at which carbon is deposited from the gas permeating the artifact to impregnate fully the initial zone. The temperature of the impregnated zone is then raised progressively to maintain the temperature within an advancing impregnated/non-impregnated boundary zone, and the rate of the rise in temperature in the initial zone is limited, so that the advancing boundary zone is fully impregnated. Carley-Macauly, column 1, lines 20 to 30. The process increases the thermal resistance in the impregnated zone. Carley-Macauly, column 1, lines 43 to 46. Therefore, the process disclosed by Carley-Macauly decreases the thermal conductivity of the artifact. Carley-Macauly teaches and claims that desirable properties of the artifact include low thermal conductivity. Carley-Macauly, column 1, lines 31 and 32, and claims 1, 2, 6, 9, and 10.

The Examiner respectfully disagrees with this argument. First of all, as acknowledged by Applicants, Carley-Macauly teaches carbon impregnated artefacts (See column 1, lines 11-12), and the carbon-impregnated artifacts are produced by placing **an artifact, having high open porosity and low thermal conductivity**, in an atmosphere of hydrocarbon gas (See column 1, lines 20-23). In other words, it is clear that it's **the artifact** (not the *carbon* impregnated artifact) has high open porosity and low thermal conductivity. The process described at column 1, lines 43 to 46 increases the thermal resistance of the artifact impregnated with a hydrocarbon before converting it to carbon. Carley-Macauly teaches also that suitable artefacts consist of ***carbon*** **masses of high open porosity** (See column 2, lines 27-28). Clearly, ***carbon*** masses of **high open porosity** have low thermal conductivity due to high open porosity because gas in the open pores is not a conductive material. Therefore, carbon coating that reduces open porosity will clearly increase thermal conductivity for at least the reason that carbon has higher thermal conductivity

than gas. Moreover, Carley-Macauly teaches nowhere that carbon-impregnated artifacts have lower thermal conductivity than uncoated artefacts.

(B) Applicants submit that all of the claims of Carley-Macauly are directed to methods of preparing a carbon impregnated artifact or nuclear fuel element having low thermal conductivity. Carley-Macauly does not disclose or suggest increasing the thermal conductivity of the disclosed artifacts or fuel elements. One of ordinary skill in the art following the teaching of Carley-Macauly would understand that the thermal conductivity should be kept low, and that the thermal conductivity would be decreased by the disclosed deposition of carbon. One of ordinary skill in the art, following the teaching of Carley-Macauly, would have no reason to modify the disclosed process to increase thermal conductivity of the artifact or fuel element, and, thus, would have no reason to obtain the presently claimed invention.

The Examiner respectfully disagrees with this argument. In contrast to Applicants argument, one of ordinary skill in the art following the teaching of Carley-Macauly would understand that the thermal conductivity would be increased by the disclosed deposition of carbon because carbon has higher thermal conductivity than gas in the pores.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy Lightfoot whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Friday, 9:00AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy Lightfoot, Ph.D.
Primary Examiner
Art Unit 1792

October 2, 2008

/Elena Tsoy Lightfoot/